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CE8 Subset3: Picture Quadtree Adaptive Offset

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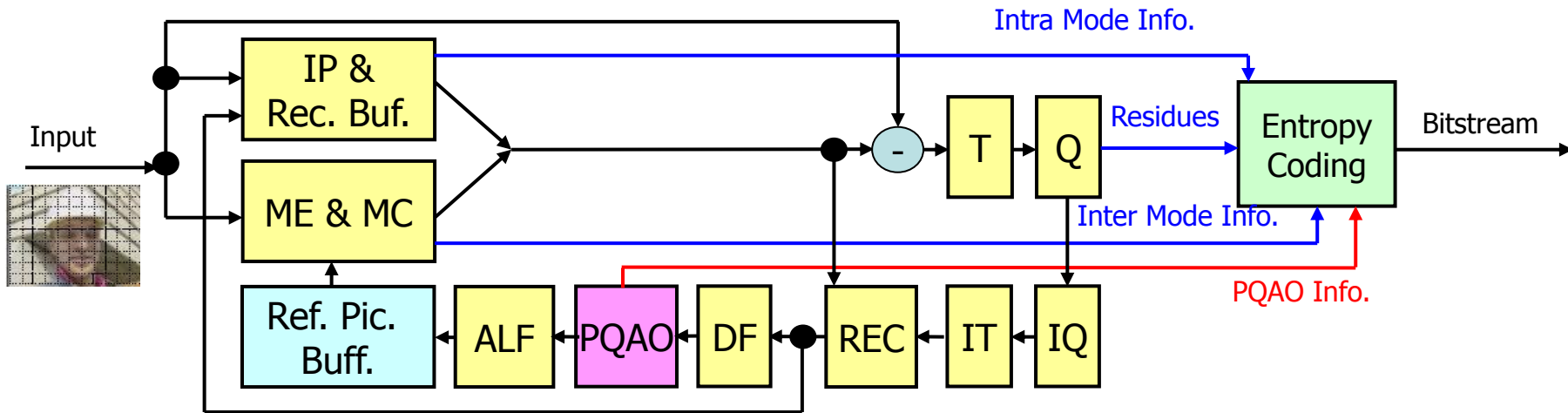
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Overall Summary

- Picture Quadtree Adaptive Offset (PQAO)
  - Located between Deblocking and Adaptive Loop Filter (ALF)
  - Local adaptation by selecting Band Offset (BO) or Edge Offset (EO) for each leaf quadtree partition of a picture
  - Pixel classification and then derive one offset for each group
  - Has much lower complexity than the ALF in TMuC0.9
    - Simpler pixel classification and only offset adjustment

- Performance in comparison with JCTVC-C500

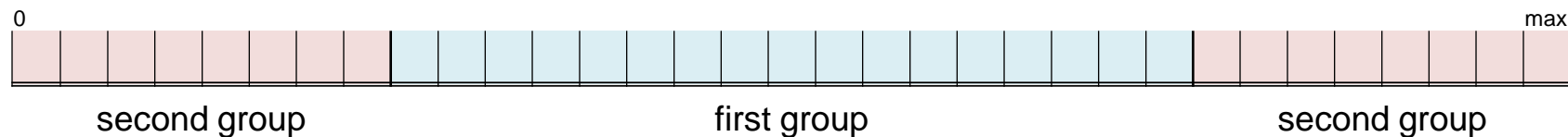|	HE-AI	HE-RA	HE-LD
BD-Rate	-0.8%	-1.5%	-2.2%
Encoding Time Increase	2.6%	1.0%	1.3%
Decoding Time Increase	2.0%	1.6%	2.7%

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Picture Quadtree Adaptive Offset

- Right after deblocking filter (DF)

- Divide a picture into multi-level quadtree partitions

- Each leaf partition can select one adaptive offset (AO) methods or no processing (OFF)
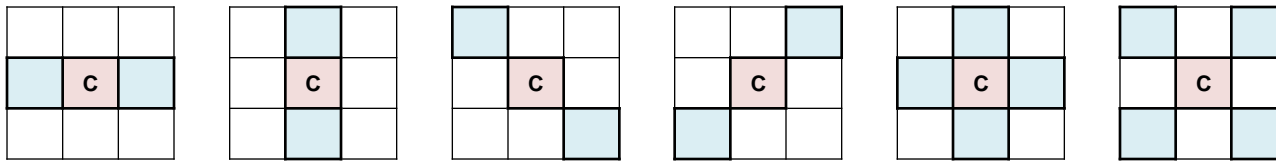
Band Offset (BO)

- Classify each pixel according to its intensity

- Intensity is equally divided into 32 bands
  – To increase the possibility of nonzero offsets in comparison with the 16-band prior art

- To reduce side information (from 32 offsets to 16)
  – Send offsets of center 16 bands (group 1)
  – Send offsets of outer 16 bands (group 2)

0   max

second group   first group   second group

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Edge Offset (EO)

- Classify each pixel by comparing with its neighboring pixels

- Send one offset for each category

- Four 1-D patterns and two 2-D patterns

1-D pattern

Category	Condition
1	c < 2 neighboring pixels
2	c < 1 neighbor && c == 1 neighbor
3	c > 1 neighbor && c == 1 neighbor
4	c > 2 neighbors
0	Nono of the above

2-D pattern

Category	Condition
1	C < 4 neighbors
2	C < 3 neighbors && C = 4th neighbor
3	C < 3 neighbors && C > 4th neighbor
4	C > 3 neighbors && C < 4th neighbor
5	C > 3 neighbors && C = 4th neighbor
6	C > 4th neighbor
0	None of the above

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Simulation Results

- JCTVC-C500 anchor

- Average BD-rate = -1.5%

- Average encoding time increase = 1.6%

- Average decoding time increase = 2.1%

	HE-AI	HE-RA	HE-LD
BD-Rate (%)	-0.8	-1.5	-2.2
Enc. T. Increase (%)	2.6	1.0	1.3
Dec. T. Increase (%)	2.0	1.6	2.7

		HE-AI	HE-RA	HE-LD
Class A	Traffic	-0.9	-0.1	
	PeopleOnStreet	-1.8	0.0	
Class B	Kimono	-0.2	0.2	-0.4
	ParkScene	-0.8	-0.3	-2.1
	Cactus	-0.5	-0.3	-2.1
	BasketballDrive	-0.6	-0.1	-0.6
	BQTerrace	-0.8	-0.8	-1.3
Class C	BasketballDrill	-1.5	-1.5	-3.0
	BQMall	-0.8	-0.6	-2.3
	PartyScene	-0.6	-0.4	-1.6
	RaceHorses	-0.6	0.0	-0.5
Class D	BasketballPass	-0.6	-0.2	-0.5
	BQSquare	-1.5	-1.6	-2.6
	BlowingBubble	-0.4	-0.4	-1.1
	RaceHorses	-0.7	-0.3	-1.1
Class E	Vidyo1	-1.0		-2.7
	Vidyo3	-1.0		-5.6
	Vidyo4	-0.8		-2.1

Cross Verification

- We thank Samsung for crosschecking our proposal
  - JCTVC-D183

- BD-rates and run times are confirmed

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Conclusions

- Picture quadtree adaptive offset (PQAO)

- Performance compared with JCTVC-C500 (QC_ALF)

	HE-AI	HE-RA	HE-LD
BD-Rate (%)	-0.8	-1.5	-2.2
Enc. Time Increase (%)	2.6	1.0	1.3
Dec. Time Increase (%)	2.0	1.6	2.7

- Propose to adopt PQAO into HM

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